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OPERATIONAL RESEARCH DIVISION

DIRECTORATE OF OPERATIONAL RESEARCH (JOINT & LAND)

ORD PROJECT REPORT PR-9709

MEASURING PRODUCTIVITY OF POSTAL SERVICES IN THEATRES OF OPERATION

by

M. Provencher

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ABSTRACT

The postal services provided in different theatres of operation were compared to one another using the data envelopment analysis (DEA) methodology. Productivity scores were obtained for each theatre. Those whose scores are low, are using minimal resources already. However, the underutilisation of personnel for these theatres of operation can benefit the units to which they are attached by employing the individuals on other tasks in addition to the ones generated by postal services.

RÉSUMÉ

Les services postaux fournis dans différents théâtres d'opération ont été comparés les uns aux autres par la méthode d'analyse d'enveloppement des données. Des taux de productivité ont été obtenus pour chaque théâtre. Ceux dont le taux était bas, utilisent déjà le minimum de ressources. Cependant la sous-utilisation du personnel dans ces théâtres d'opération peut bénéficier aux unités pour lesquelles le personnel travaille en employant ces individus à d'autres tâches qui s'ajouteraient à celles générées par les services postaux.

EXECUTIVE SUMMARY

In the fall of 1996, a study on productivity measures in transportation was requested by the Directorate of Transport and Movements (DTM). One area to be addressed by this study was Postal Services. This paper presents the methodology adopted to determine productivity scores, the data collected and the results obtained.

The postal services section of DTM provides for the effective postal support to the Canadian Forces (CF) at home and abroad. The productivity of the postal services in theatres of operation was the focus of this paper since it is the area where DTM has a major responsibility.

The productivity of post offices in each of the theatres was evaluated relative to the others for each month of 1996 using a data envelopment analysis methodology where the resources measured were the monthly salaries of the CF members on postal services in the theatre while the products measured were the dollar amount of postage sales, the number of money orders paid or sold and the weight (in kilogram) of mail sent out of the theatre.

The median scores calculated over the twelve months of 1996 show good performances in Haiti (1.00), Geilenkirchen (1.00) and Yugoslavia (0.97). The best performing post offices getting a score of one. The scores, however, are a reflection of the efficiency of the personnel and the demand for postal services, tainted by the difficulties inherent to the theatre they are in. Some did not perform so well. They are, in decreasing order of performance/score: Shape (0.73), Golan (0.52), London (0.51), and Heidleberg (0.25). All these except in the Golan had only one person in position while in the Golan two people were in place indicating that possibly only one would suffice. Underutilised people can be used and have been used for tasks other than the ones generated by postal services.

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LIST OF ABBREVIATIONS

AO	Other articles (autres objets)
CF	Canadian Forces
CFPO	Canadian Forces Post Office
CFPU	Canadian Forces Postal Unit
CP	Parcel posts (colis postaux)
CPC	Canada Post Corporation
Cpl	Corporal
DEA	Data Envelopment Analysis
DMU	Decision Making Unit
DND	Department of National Defence
DTM	Directorate of Transport and Movements
LC	Letters and postcards (lettres et cartes postales)
MCpl	Master Corporal
MPO	Military Post Office
Sgt	Sergeant

MEASURING PRODUCTIVITY OF POSTAL SERVICES IN THEATRES OF OPERATION

I. INTRODUCTION

1. In October 1996, a study on productivity measures in transportation was requested by the Directorate of Transport and Movements (DTM) [1]. Five key areas of transportation were to be addressed: personnel transportation, furniture and effects, postal services, operational movements - materiel traffic, and fleet management. These areas reflect the current composition of DTM. This report assesses Postal Services.

2. The Postal Services were reviewed from a performance analysis point of view. The data collected on services provided were analysed and a method was derived attributing productivity scores to each Canadian Forces Post Office (CFPO). This report presents the method used, the results obtained, and their interpretation.

II. POSTAL SERVICES ON BASES AND IN THEATRES OF OPERATION

3. The postal services section of DTM provides for effective postal support to the Canadian Forces (CF) at home and abroad. It establishes working relationships with foreign and domestic postal authorities (the Canada Post Corporation) to effect such services. It develops plans and procedures for provision of postal services to operational forces outside Canada, and monitors the operation of postal services within the Department of National Defence (DND). References [2] and [3] provide more detail on postal services in DND.

4. A Military Post Office (MPO) may be provided to serve a defence establishment in Canada where Canada Post Corporation (CPC) considers the requirement to be substantiated and on the recommendation of DND. Such post offices are very much like your local post office. They are monitored by CPC and DND.

5. A Canadian Forces Post Office (CFPO), is a DND post office located outside Canada to respond to the requirements of CF members deployed in theatres of operation. Theatre of operation, here, takes a broader sense to include external CF establishments as in Germany.

6. Besides DTM, the MPOs, and the CFPOs, there is a Canadian Forces Postal Unit (CFPU) located in Trenton which centralizes, sorts and dispatches official and personal mail to CF overseas and Canadian Forces Station Alert. The CFPU and its four regional detachments provide postal service and support to bases and stations in Canada.

7. In this paper, it is the efficiency of the CFPOs that was addressed since this is where DTM has the most responsibility.

III. PRODUCTIVITY MEASURES AND DATA ON SERVICES PROVIDED

8. When looking at productivity measures, we are looking at measures of output relative to input. Ideally to get the total productivity of a CFPO we would want to measure all that is produced by that CFPO and divide this by a measure of all the resources used by that CFPO. In practice, it is difficult to evaluate a total productivity measure either because all of the information is not available or because a measure combining different types of products or resources is not applicable [4].

9. CFPOs, as mentioned earlier, are Canadian Forces Post Offices in theatres of operation. They are the only Canadian Post Offices on foreign soil. Like any other DND post office they handle the internal correspondence called the CF post (no postage) and the personal mail (with postage). The CF post is a system designed and operated on a limited regional basis by the Canadian Forces Postal Service to deliver internal correspondence to

bases and stations mainly in Canada and selected CFPO addresses overseas, using CF manpower and transportation resources. That is why no postage applies in this case.

10. Mail comes in different forms: letters and postcards (LC), parcel posts (CP), and other articles such as magazines (AO).

11. Mail is transported to and from CFPOs in three ways: through the DND Service airlift, through CPC International Air Mail or through Commercial Freight Forwarders i.e. Commercial Airlifts, depending on airlift schedules, urgency and prices. Sea containers are no longer used for mail. And of course CF Post is only transported through DND Service airlift.

12. Despite the fact that CFPOs operate in different and possibly difficult environments, good records of their activities are kept. The dollar amount of postage sales is known. The number of money orders paid or sold is tracked. And the weight (in kilograms, kg) of mail sent out through the different means of transportation is recorded. This information was collated, by DTM, for all the months in 1996 from the seven foreign locations where there were CFPOs. In addition to this information, the rank and number of the CF members working at the CFPOs was gathered. The whole set of data can be found in Annex A. Timeliness of mail was not a factor considered in comparing CFPOs because it is not currently measured and is so dependent on the availability of flights.

13. Thus three monthly measures of output were available: the dollar amount of postage sales, the number of money orders sold and paid, and the weight in kg of mail sent from the CFPO. While one measure of input was available: the monthly cost of CF members at the CFPO. The latter cost was derived from the full annual cost of CF members taken from the Cost Factors Manual [5], see Table I.

TABLE I
COST OF CF MEMBERS

Rank	Full Annual Cost
Sergeant (Sgt)	$ 61 486.
Master Corporal (MCpl)	$ 58 087.
Corporal (Cpl)	$ 55 232.

14. A Data Envelopment Analysis (DEA) was used to derive productivity measures for each CFPO, for each month of 1996. The DEA was done for each month in order to see whether a CFPO's accomplishment would vary much within a year. The DEA derives productivity ratings whose maximum value is one. The ratings given to each CFPO rely on comparisons made with the other CFPOs. Thus a rating of one for a CFPO means that amongst all CFPOs, this one is one of the best. Of course if all CFPOs are not very productive, it only means that this CFPO is one of the best amongst them. Moreover the method provides productivity scores that represent each CFPO favorably. This means that when the score is low the CFPO is really doing poorly relative to the others. Annex B presents the DEA methodology used for each month while Annex C provides a sample LINDO program used to solve it. LINDO is a computer program with its own language allowing a user to input a linear program formulation and solve it. More information on LINDO can be found in [10].

15. It is important to note here that in some papers on the Data Envelopment Analysis, emphasis is placed on the homogeneity of the units (CFPOs) being compared. The CFPOs are homogeneous in terms of the functions they have to accomplish; however, their environments are very different with specific logistic's problems when it comes to sending the mail that may impact on their productivity. Henceforth, conclusions on the productivity of CFPOs are a reflection of the demand for mail services, and the productivity of the people tainted by the environment they are placed in.

IV. RESULTS AND THEIR INTERPRETATION

16. The productivity scores obtained for each CFPO for each month of 1996 can be found in Table II along with the median, 25th and 75th percentiles. The median is a good representation of the performance of each CFPO. A median of 0.97 for the CFPO in Yugoslavia means that 50% of the productivity scores for Yugoslavia were below 0.97 while 50% were above. The median is a good measure of the centrality of the values obtained. The 25th and 75th percentiles are the productivity values for which 25% and 75% (respectively) of the observations were below. If the median and 25th, 75th percentiles are very close, that

TABLE II

(a) Monthly Productivity Scores

CFPO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golan	0.42	1.00	0.30	0.34	0.64	0.33	0.63	0.61	0.20	0.63	0.78	0.33
Yugoslavia	0.77	1.00	1.00	0.89	0.78	1.00	1.00	1.00	0.80	0.56	0.94	1.00
Shape	0.94	0.83	0.67	0.53	0.55	0.68	0.76	0.71	0.53	0.74	0.92	1.00
London	0.49	0.57	0.43	0.26	0.33	0.22	0.59	0.78	0.27	0.53	0.83	0.57
Geilenkirchen	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heidleberg	0.27	0.27	0.36	0.26	0.24	0.24	0.22	0.19	0.23	0.21	0.49	0.25
Haiti	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

(b) Median Productivity Scores

CFPO	25th percentile	Median	75th percentile
Golan	0.33	0.52	0.63
Yugoslavia	0.80	0.97	1.00
Shape	0.64	0.73	0.85
London	0.32	0.51	0.58
Geilenkirchen	1.00	1.00	1.00
Heidleberg	0.23	0.25	0.27
Haiti	1.00	1.00	1.00

means there is not much variation in the monthly productivity scores over the year. Such is the case for Haiti, Geilenkirchen and Heidleberg as illustrated in Figure 1. All other CFPOs productivity show much more variation within a year. The scores are a function of the weights determined by the data envelopment analysis. These weights can be found in Annex D. A productivity score of 0.52 suggests the CFPO could provide its current mix and volume of service with only about 52% of the resources it actually consumed. A less productive CFPO, i.e., one with a score of less than 100% should be compared with a best practice CFPO (one with a 100% score) that provides its volume and mix of services with fewer resources than the less productive CFPO.

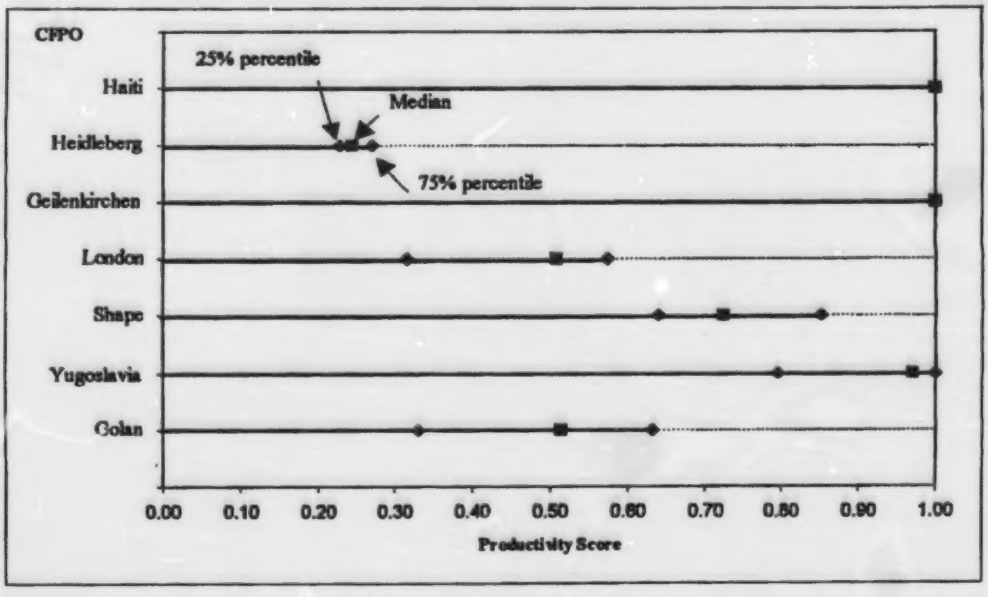

Figure 1: Productivity Scores of CFPOs

17. Table III shows the median productivity scores for each CFPO along with the resources used by the CFPO. Since the CFPOs in Shape, London, and Heidleberg use only one individual, their productivity ratings are difficult to improve: we cannot use less than a person. This indicates that in these locations those individuals are underutilised so they could be used and some are, for tasks other than the ones related to running the CFPO. In the case of the Golan CFPO, the number of individuals could theoretically be cut to one Sergeant since even with the 75th percentile, the productivity is at 0.63, implying that 63% of the resources (a Sergeant and a Master Corporal) should be sufficient to do the job. In practice though, some months such as February and November might be difficult to handle by a single person; a backup is needed particularly on difficult missions. Shape, London and Heidleberg are manned by only one individual but the Corporal from Geilenkirchen can fill in if temporarily needed. Such is not the case in the Golan. Thus the current arrangements are sensible. The productivity rating of 1.00 in December for the Shape CFPO, which uses only one individual, provides an idea of the amount of work that would be accomplished per person in a month. In December at Shape, the Canadian postage sales handled by the Sergeant were $2 372.60, the number of money orders sold/paid was 94, and the total mail in kg was 1572.

TABLE III

PRODUCTIVITY AND RESOURCES

CFPO	Median	Resources
Golan	0.52	Sgt/MCpl
Yugoslavia	0.97	Sgt/MCpl/Cpl
Shape	0.73	Sgt
London	0.51	Sgt
Geilenkirchen	1.00	Sgt/Cpl
Heidleberg	0.25	Sgt
Haiti	1.00	Sgt/MCpl/Cpl

18. This method of measuring productivity could be applied periodically as a way of confirming the adequacy of the set-up in the CFPOs. The method might also be improved by trying to account for the characteristics specific to each theatre of operation and possibly having an influence on its productivity.

V. CONCLUSION

19. The productivity of Canadian Forces Post Offices in theatres of operation was evaluated. Productivity scores of CFPOs were determined from comparisons with one another. They showed that the current arrangements are sensible. The CFPOs for which productivity scores are low relative to the others suggest that potential manpower savings are possible. These CFPOs are already using the minimum resources (one individual assuming all postal services) except for the Golan where the number of individuals could be reduced to one. In this latter case, however, the nature of the mission justifies the need for a back-up.

20. The productivity of postal services was limited in this paper to that of the CFPOs. It would be worthwhile to broaden the study of productivity to the MPOs and CFPU detachments. For all aspects of postal services to be covered such as the MPOs on the bases, endorsement should be made on a wider basis.

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ANNEX A
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CFPO DATA

Each of the following tables represent the data for one Canadian Forces Post Office (CFPO), for all months in 1996.

CFPO 5002 - GOLAN	JAN 96	FEB 96	MAR 96	APR 96	MAY 96	JUN 96	JUL 96	AUG 96	SEP 96	OCT 96	NOV 96	DEC 96
Postage meter settings	0	0	0	0	0	0	0	0	0	0	0	0
Stamp Sales	$1,027.81	$3,094.89	$2,123.77	$1,597.93	$2,994.85	$1,696.38	$2,203.64	$2,948.71	$959.55	$2,277.51	$3,514.50	$1,607.72
Canadian Postage Sales	$1,027.81	$3,094.89	$2,123.77	$1,597.93	$2,994.85	$1,696.38	$2,203.64	$2,948.71	$959.55	$2,277.51	$3,514.50	$1,607.72
Money Orders sold	32	31	35	17	36	58	48	44	41	33	46	43
Money Orders paid	0	0	0	0	0	0	0	0	0	0	3	0
Money Orders sold/paid	32	31	35	17	36	58	48	44	41	33	49	43
Airmail (kg)	41	52	59	44	34	73	52	53	48	44	63	51
Svc Air (LC/AO/CP) (kg)	384	364	223	399	593	250	660	1718	567	452	2182	700
Commercial (LC/AO/CP) (kg)	280	474	560	0	0	0	1045	760	243	892	1153	124
CF Post (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Total Mail (kg)	705	890	842	443	627	323	1757	2531	858	1388	3398	875
Personnel/rank	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL	SGT/MCPL

CFPO 5003 - YUGOSLAVIA	JAN 96	FEB 96	MAR 96	APR 96	MAY 96	JUN 96	JUL 96	AUG 96	SEP 96	OCT 96	NOV 96	DEC 96
Postage meter settings	0	0	0	0	0	0	0	0	0	0	0	0
Stamp Sales	$1,828.96	$2,776.95	$3,447.00	$3,037.43	$4,352.43	$7,646.12	$3,483.27	$2,774.23	$2,804.11	$3,124.58	$5,247.28	$5,133.01
Canadian Postage Sales	$1,828.96	$2,776.95	$3,447.00	$3,037.43	$4,352.43	$7,646.12	$3,483.27	$2,774.23	$2,804.11	$3,124.58	$5,247.28	$5,133.01
Money Orders sold	144	549	626	372	342	246	360	504	339	283	259	129
Money Orders paid	1	2	3	4	6	3	2	0	0	0	1	0
Money Orders sold/paid	145	551	629	376	348	249	362	504	339	283	260	129
Airmail (kg)	27	0	0	0	0	0	0	0	0	0	0	0
Svc Air (LC/AO/CP) (kg)	1728	1805	2311	2712	3934	9255	5078	7919	2215		5785	6468
Commercial (LC/AO/CP) (kg)	0	0	0	0	0	0	0	0	0		0	0
CF Post (kg)	123	98	161	99	120	174	446	155	121		215	169
Total Mail (kg)	1878	1903	2472	2811	4054	9429	5524	8074	2336	0	6000	6637
Personnel/rank	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCPL/CP	SGT/MCPL/CPL

CFPO 5048 - SHAPE	JAN 96	FEB 96	MAR 96	APR 96	MAY 96	JUN 96	JUL 96	AUG 96	SEP 96	OCT 96	NOV 96	DEC 96
Postage meter settings	0	0	0	0	0	0	0	0	0	0	0	0
Stamp Sales	$1,546.27	$1,216.56	$1,859.93	$1,136.59	$1,310.27	$1,764.86	$1,327.10	$1,787.09	$1,051.28	$1,411.02	$2,928.51	$2,372.60
Canadian Postage Sales	$1,546.27	$1,216.56	$1,859.93	$1,136.59	$1,310.27	$1,764.86	$1,327.10	$1,787.09	$1,051.28	$1,411.02	$2,928.51	$2,372.60
Money Orders sold	97	90	120	73	65	81	112	125	74	88	105	91
Money Orders paid	2	1	6	1	1	2	2	4	6	2	4	3
Money Orders sold/paid	99	91	126	74	66	83	114	129	80	90	109	94
Airmail (kg)	77	55	105	73	58	79	66	75	72	66	89	91
Svc Air (LC/AO/CP) (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Commercial (LC/AO/CP) (kg)	394	306	386	403	300	574	395	813	336	554	922	1481
CF Post (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Total Mail (kg)	471	361	491	476	358	653	461	888	408	620	1011	1572
Personnel/rank	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT

CFPO 5051 - LONDON	JAN 96	FEB 96	MAR 96	APR 96	MAY 96	JUN 96	JUL 96	AUG 96	SEP 96	OCT 96	NOV 96	DEC 96
Postage meter settings	0	0	1	0	0	0	0	0	0	0	0	0
Post. setting of $2000 in year	$166.67	$166.67	$166.67	$166.67	$166.67	$166.67	$166.67	$166.67	$166.67	$166.67	$166.67	$166.67
Stamp Sales	$650.56	$603.17	$567.84	$394.73	$629.20	$400.21	$926.32	$1,787.09	$631.88	$848.14	$2,426.95	$1,385.78
Canadian Postage Sales	$817.23	$769.84	$734.51	$561.40	$795.87	$566.88	$1,092.99	$1,953.76	$798.55	$1,014.81	$2,593.62	$1,552.45
Money Orders sold	48	74	94	35	45	31	42	125	38	49	94	
Money Orders paid	1	0	1	1	0	0	0	0	0	1	1	1
Money Orders sold/paid	49	74	95	36	45	31	42	125	38	50	95	1
Airmail (kg)	50	56	89	66	58	46	50	54	64	69	72	80
Svc Air (LC/AO/CP) (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Commercial (LC/AO/CP) (kg)	183	155	260	136	300	207	289	389	361	358	1055	350
CF Post (kg)	0	174	0	0	0	37	74	0	0	0	0	0
Total Mail (kg)	233	385	349	202	358	290	413	443	425	427	1127	430
Personnel/rank	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT

CFPO 5053 - GEILENKIRCHEN	JAN 96	FEB 96	MAR 96	APR 96	MAY 96	JUN 96	JUL 96	AUG 96	SEP 96	OCT 96	NOV 96	DEC 96
Postage meter settings	0	0	0	0	0	0	0	0	0	0	0	0
Stamp Sales	$3,210.72	$2,156.23	$4,454.44	$2,627.01	$3,645.02	$2,316.51	$3,275.10	$4,713.98	$3,457.45	$3,710.66	$6,046.15	$5,170.76
Canadian Postage Sales	$3,210.72	$2,156.23	$4,454.44	$2,627.01	$3,645.02	$2,316.51	$3,275.10	$4,713.98	$3,457.45	$3,710.66	$6,046.15	$5,170.76
Money Orders sold	307	327	436	315	307	336	317	389	294	391	422	305
Money Orders paid	5	3	4	5	11	6	1	7	5	11	23	8
Money Orders sold/paid	312	330	440	320	318	342	318	396	299	402	445	313
Airmail (kg)	128	124	150	156	120	155	202	293	156	149	172	138
Svc Air (LC/AO/CP) (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Commercial (LC/AO/CP) (kg)	679	519	776	549	529	636	623	1102	530	624	2271	1491
CF Post (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Total Mail (kg)	807	643	926	705	649	791	825	1395	686	773	2443	1629
Personnel/rank	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL	SGT/CPL

CFPO 5055 - HEIDLEBERG	JAN 96	FEB 96	MAR 96	APR 96	MAY 96	JUN 96	JUL 96	AUG 96	SEP 96	OCT 96	NOV 96	DEC 96
Postage meter settings	0	0	0	0	0	0	0	0	0	0	0	0
Stamp Sales	$331.21	$340.78	$1,291.71	$443.80	$346.01	$438.56	$288.63	$447.95	$742.46	$373.57	$1,571.43	$566.99
Canadian Postage Sales	$331.21	$340.78	$1,291.71	$443.80	$346.01	$438.56	$288.63	$447.95	$742.46	$373.57	$1,571.43	$566.99
Money Orders sold	37	40	39	40	37	39	37	38	28	31	46	34
Money Orders paid	0	0	0	0	3	1	0	1	0	0	3	3
Money Orders sold/paid	37	40	39	40	40	40	37	39	28	31	49	37
Airmail (kg)	10	10	11	10	13	10	8	10	9	10	19	29
Svc Air (LC/AO/CP) (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Commercial (LC/AO/CP) (kg)	142	59	1109	244	108	173	82	169	478	329	540	329
CF Post (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Total Mail (kg)	152	69	1120	254	121	183	90	179	487	339	559	358
Personnel/rank	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT	SGT

CFPO 5057 - HAITI	JAN 96	FEB 96	MAR 96	APR 96	MAY 96	JUN 96	JUL 96	AUG 96	SEP 96	OCT 96	NOV 96	DEC 96
Postage meter settings	0	0	0	0	0	0	0	0	0	0	0	0
Stamp Sales	$3,975.07	$4,538.93	$10,196.46	$6,856.86	$6,826.46	$7,004.25	$5,225.82	$7,165.10	$13,759.50	$4,765.15	$6,706.25	$5,965.56
Canadian Postage Sales	$3,975.07	$4,538.93	$10,196.46	$6,856.86	$6,826.46	$7,004.25	$5,225.82	$7,165.10	$13,759.50	$4,765.15	$6,706.25	$5,965.56
Money Orders sold	234	238	323	359	444	448	289	506	374	508	519	505
Money Orders paid	1	1	3	1	1	3	0	3	4	2	5	4
Money Orders sold/paid	235	239	326	360	445	451	289	509	378	510	524	509
Airmail (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Svc Air (LC/AO/CP) (kg)	0	0	0	1908	3582	4939	3988	5999	6146	6766	6387	4696
Commercial (LC/AO/CP) (kg)	2433	4189	9762	3459	1645	1480	0	0	0	0	0	0
CF Post (kg)	0	0	0	0	0	0	0	0	0	0	0	0
Total Mail (kg)	2433	4189	9762	5367	5227	6419	3988	5999	6146	6766	6387	4696
Personnel/rank	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCP/CPL	SGT/MCPL/CPL	SGT/MCPL/CPL

ANNEX B
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DATA ENVELOPMENT ANALYSIS METHODOLOGY

1. In the basic DEA methodology, a number of decision making units (DMUs) are compared. In this specific analysis, DMUs are CFPOs. Each of which uses various amounts of a number of distinct inputs to produce various levels of a number of distinct outputs. The CFPOs are indexed by $j = 1, 2, ..., 7$ since there are seven theatres of operation, the inputs by $i = 1$ for the cost of CF members, and the outputs by $r = 1, 2, 3$ for the dollar amount of postage sales, the number of money orders sold and paid, and the weight in kg of mail sent from the CFPO, respectively. X_{ij} is the amount of input i used by CFPO j and Y_{rj} is the amount of output r produced by CFPO j. DEA seeks to get the best productivity score for each CFPO. DEA seeks optimal solutions to the k fractional programs:

$$Max\ P_k = \frac{\sum_r u_{rk}\ Y_{rk}}{\sum_i v_{ik}\ X_{ik}}$$

subject to

$$\frac{\sum_r u_{rk}\ Y_{rj}}{\sum_i v_{ik}\ X_{ij}} \leq 1 \qquad \forall j$$

$$u_{rk} \geq 0 \qquad \forall r$$

$$v_{ik} \geq 0 \qquad \forall i$$

2. That is for each CFPO, its productivity is determined by a weighted sum of outputs over a weighted sum of inputs. The weights being chosen such that they are non-negative, and the productivity of all CFPOs with these weights do not exceed one. It is understood that all *X*s and *Y*s are non-negative and that for given amounts of input (*X*s), the amounts of output (*Y*s) augment with productivity.

3. Thus for each CFPO, weights are chosen so that this CFPO gets its best productivity value. That being done for all CFPOs, the results are productivity scores that represent each one favorably. Each CFPO score obtained is the highest score that could be attributed to this CFPO from comparison to the other CFPOs. What this means is that when the score is low the CFPO is really doing poorly relative to the others. Also since the ratings are based from comparisons from one another, it is important to note that if all CFPOs are very productive, a CFPO with a poor rating might not be so bad after all.

4. References [6], [7], [8] provide good discussions of the data envelopment analysis. The formulation presented above can be easily converted into k linear programs:

$$Max \quad P_k = \sum_r u_{rk} Y_{rk}$$

subject to

$$\sum_r u_{rk} Y_{rj} - \sum_i v_{ik} X_{ij} \leq 0 \qquad \forall j$$

$$\sum_i v_{ik} X_{ik} = 1$$

$$u_{rk} \geq 0 \quad \forall r, \qquad v_{ik} \geq 0 \quad \forall i$$

or yet

$$Max \; P_k = \sum_{r=1}^{3} u_{rk} Y_{rk}$$

subject to

$$\sum_{r=1}^{3} u_{rk} Y_{rj} - v_{1k} X_{1j} \leq 0 \qquad j = 1,2,\ldots,7$$

$$v_{1k} X_{1k} = 1$$

$$u_{rk} \geq 0 \qquad r = 1,2,3$$

$$v_{1k} \geq 0$$

5. Ideally, we would want to impose that all weights be positive, to force the inclusion of all inputs and outputs in the determination of the productivity scores. However due to the large variation in the values of inputs and outputs, this may not be handled by all linear programming packages.

6. By ensuring that the number of parameters used is less than or about half the number of DMUs considered, we avoid solutions that take advantage of the particularities of a DMU [9].

ANNEX C
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SAMPLE PROGRAM

Sample program for CFPO 5002 in the Golan for the month of June 1996.

```
!  CFPO.DAT
BAT
!
!  A DEA model to maximize the productivity or efficiency rating
!  for CFPO k=1  (1-GOLAN, 2-YUGOSLAVIA, 3-SHAPE, 4-LONDON,
!                 5-GEILENKIRCHEN, 6-HEIDLEBERG, 7-HAITI)
!
MAX 1696.38 U11 + 58 U21 + 323 U31
SUBJECT TO
2) 1696.38 U11 + 58 U21 + 323 U31 - 9964.42 V1 <= 0
3) 7646.12 U11 + 249 U21 + 9429 U31 - 14567.08 V1 <= 0
4) 1764.86 U11 + 83 U21 + 653 U31 - 5123.83 V1 <= 0
5) 566.88 U11 + 31 U21 + 290 U31 - 5123.83 V1 <= 0
6) 2316.51 U11 + 342 U21 + 791 U31 - 9726.5 V1 <= 0
7) 438.56 U11 + 40 U21 + 183 U31 - 5123.83 V1 <= 0
8) 7004.25 U11 + 451 U21 + 6419 U31 - 14567.08 V1 <= 0
9) 9964.42 V1 = 1
END
! Type "GO" to solve the model
BAT
LEAVE
```

ANNEX D
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WEIGHTS OBTAINED

Each of the following tables represent the weights and scores obtained for one CFPO, for all months in 1996.

Golan	January	February	March	April	May	June	July	August	September	October	November	December
Postage Sales	0.000000	0.000322	0.000143	0.000213	0.000214	0.000173	0.000150	0.000074	0.000000	0.000256	0.000000	0.000163
Money Orders	0.000000	0.000000	0.000000	0.000000	0.000000	0.000551	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Mail (kg)	0.000601	0.000000	0.000000	0.000000	0.000000	0.000000	0.000170	0.000156	0.000238	0.000036	0.000229	0.000080
Personnel	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100
Score	0.42	1.00	0.30	0.34	0.64	0.33	0.63	0.61	0.20	0.63	0.78	0.33

Yugoslavia	January	February	March	April	May	June	July	August	September	October	November	December
Postage Sales	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000180	0.000000	0.000000
Money Orders	0.000000	0.001815	0.001434	0.001967	0.002069	0.000000	0.000000	0.000000	0.002165	0.000000	0.000000	0.000000
Mail (kg)	0.000411	0.000000	0.000040	0.000054	0.000015	0.000106	0.000181	0.000124	0.000030	0.000000	0.000157	0.000151
Personnel	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069
Score	0.77	1.00	1.00	0.89	0.78	1.00	1.00	1.00	0.80	0.56	0.94	1.00

Shape	January	February	March	April	May	June	July	August	September	October	November	December
Postage Sales	0.000505	0.000493	0.000208	0.000181	0.000416	0.000337	0.000497	0.000364	0.000000	0.000497	0.000314	0.000282
Money Orders	0.000000	0.002530	0.002205	0.004444	0.000000	0.001071	0.000851	0.000456	0.006156	0.000000	0.000000	0.000000
Mail (kg)	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000084	0.000070	0.000000	0.000210
Personnel	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195
Score	0.94	0.83	0.67	0.53	0.55	0.68	0.76	0.71	0.53	0.74	0.92	1.00

London	January	February	March	April	May	June	July	August	September	October	November	December
Postage Sales	0.000505	0.000493	0.000014	0.000181	0.000416	0.000337	0.000544	0.000397	0.000000	0.000497	0.000233	0.000367
Money Orders	0.000000	0.002530	0.003863	0.004444	0.000000	0.001071	0.000000	0.000000	0.006156	0.000000	0.000000	0.000000
Mail (kg)	0.000344	0.000000	0.000148	0.000000	0.000000	0.000000	0.000000	0.000000	0.000084	0.000070	0.000201	0.000000
Personnel	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195
Score	0.49	0.57	0.43	0.26	0.33	0.22	0.59	0.78	0.27	0.53	0.83	0.57

Geilenkirchen	January	February	March	April	May	June	July	August	September	October	November	December
Postage Sales	0.000000	0.000209	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000053
Money Orders	0.003205	0.001665	0.002273	0.003125	0.003145	0.002924	0.003145	0.002525	0.003344	0.002488	0.002247	0.002326
Mail (kg)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Personnel	0.000103	0.000103	0.000103	0.000103	0.000103	0.000103	0.000103	0.000103	0.000103	0.000103	0.000103	0.000103
Score	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Heidleberg	January	February	March	April	May	June	July	August	September	October	November	December
Postage Sales	0.000000	0.000493	0.000279	0.000000	0.000000	0.000086	0.000000	0.000036	0.000000	0.000497	0.000314	0.000265
Money Orders	0.004082	0.002530	0.000000	0.005591	0.005881	0.004968	0.005969	0.004059	0.000000	0.000000	0.000000	0.000669
Mail (kg)	0.000774	0.000000	0.000000	0.000155	0.000043	0.000000	0.000000	0.000086	0.000463	0.000070	0.000000	0.000197
Personnel	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195	0.000195
Score	0.27	0.27	0.36	0.26	0.24	0.24	0.22	0.19	0.23	0.21	0.49	0.25

Haiti	January	February	March	April	May	June	July	August	September	October	November	December
Postage Sales	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000103	0.000050	0.000073	0.000000	0.000000	0.000000
Money Orders	0.000000	0.000000	0.000000	0.000000	0.000000	0.001134	0.000000	0.000000	0.000000	0.000000	0.001166	0.001965
Mail (kg)	0.000411	0.000239	0.000102	0.000186	0.000191	0.000076	0.000116	0.000107	0.000000	0.000148	0.000061	0.000000
Personnel	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069
Score	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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